

# Environmental Influences on the Mechanical Behavior of Unsaturated Soils

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**ABSTRACT:** Unsaturated soil mechanics play a significant role when designing earth structure like embankments, dams, dykes and their foundations. They are commonly designed in shallow subsoil depth. Their mechanical properties are susceptible to the hydraulic status and history which is dominantly by the climate environments. Soil Water Retention Curves (SWRC) determination is crucial when analysing geotechnical parameters of the soil, especially when analysing rainfall triggered slope failures. The present paper focuses on analysing SWRC for reconstituted sand and clay samples, prepared at different moisture contents and subjected to climatic drying cycles. To imitate changing *in situ* environmental conditions the analysed soil samples of sand and clay were subjected to drying cycles using environmental chamber, and then were analysed in terms of mechanical and hydraulic parameters changes. Using climate chamber allowed the relative humidity and the temperature to be fully controlled prior the final testing. As the soil suction has an impact on mechanical strength of the filling material for earth structures, thus the testing comprised multi task approach. The first step was to determine SWRC of analysed soil samples and then measure the geotechnical parameter changes due to changes in water content, controlled in the environmental chamber. The methods used for obtaining the suction curves were the tensiometer, attached at the bottom of the sample, for cohesive material, and the axial translation technique for both sand and clay samples. For the first method the pore water pressure transducer was used, for the latter one, the triaxial Bishop & Wesley cell was modified. For the purpose of SWRC determination, using axial translation technique, the triaxial cell was equipped with a high air entry value porous disc. Direct volume change of the air phase was measured by using a pore air pressure/volume controller of 1000 cc volume. The same cell was used to measure geotechnical parameters of samples subjected to different saturation conditions for consolidated undrained test. The mechanical and hydraulic behaviour measurements for unsaturated soils, for geotechnical design purposes, undoubtedly require precise determination of water retention. The present study reviews and compares laboratory methods on measuring suction for sand and clay samples of different initial water contents, and provides information on mechanical parameters influenced by changes in soil suction.

**KEY WORDS:** vadose zone, environmental chamber, negative pore water pressures, high air entry value, shear strength.